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CO-OPERATION IN NATURE

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CO-OPERATION IN NATURE

By Professor J. A. Sherrard.

THE subject allotted to me is, as your chairman says, "Co-operation in Nature." This title ought to connote a sufficiently wide implication, involving as it does, essentially all co-operation. However, those responsible for my being here have limited it to those forms that appear in infra-civilized man. That leaves abundant territory for description, but unfortunately there is very little of this whole series of areas that has been scientifically explored.

The structure of the lower animals has been and is being thoroughly investigated, but the behavior patterns are largely either unknown or at the mercy of prejudiced guesses. The subject is one of scientific investigation and is within the sphere of what may be called comparative social psychology. If you are familiar with general psychology today you will know how unsettled are its ultimate presuppositions; that it is only a science in the beginning; that social psychology has hardly made a scientific beginning, and that there is very little reliable data for the vast realm of what I have called comparative social psychology.

The literature of the subject lies for the most part in incidental references to animal behavior in more or less popular travel stories, in books on biology subjects. The only general reference in English is Prince Kropotkin's little book "Mutual Aid." W. M. Wheeler has done very valuable work in his "Social Life Among the Insects," and there are valuable social behavior references in Kechler's psychological studies of the apes.

I take it that, as breeders of plants and animals, you are all in agreement with me in a theory of evolution, that is, that in the history of all things, organic and inorganic, there is a development from simplicity to complexity, a gradual advance from a simple or rudimentary condition to one that is more complex and of a higher character. For the initiation of the theory we are indebted to Darwin; but in addition to the bare theory, there have become associated with Darwin's name, theories as to the way in which the process of evolution works itself out, particularly "natural selection" and "the survival of the fittest." Unfortunately, both of these theories were taken up and interpreted in terms of the prevalent English individualistic philosophy without adequate regard to the facts of animal behavior; and for a generation or two after Darwin, biology was regarded as bringing a scientific corroboration to a political philosophy whose founder was Thomas Hobbes.

The works of writers in the Victorian era abound in such expressions as "the struggle for existence," "survival of the fittest for struggle," "nature, red in tooth and claw," and in discussions assuming the sury-

hunting competition in the development, growth, and behavior of all animals and plants. This struggle, as you know, was supposed to constitute the basis for the survival of favored forms through natural selection. There is no doubt an element of truth in all this, but at the most it is no more than half of the whole truth, if that much.

But to go back to Hobbes. His contention was that man in a state of nature was irrevocably selfish and individualistic; that the state of nature was a state of warfare, every man in competition with every other man. The law of life among primitive men—and running through civil life—was war of each against all. A permanent fight between individuals. It is true that Hobbes allowed reason to enter this internecine chase and lead men to enter a contract by which their native selfishness might be better satisfied in obtaining more through giving up a little. This is not the place for a discussion of political philosophy, but this must be said. In the first place, Hobbes' theory of a state of nature is absolutely without historical evidence; and in the second place our psychology finds no corroboration of the function Hobbes gives to reason. Reason, or intellect, is a guide to action, but finds the drives to such action far back in the inherited nature of man. If, therefore, there is nothing in man's nature that makes for sociality, or mutual aid, or co-operation, then man never can, nor never has reached a civil state in any degree.

Our particular interest in Hobbes, however, lies in the fact that his philosophy was that of the post-Darwinians, such as Huxley; and it is through them that it has become almost axiomatic that the normal state of existence, not only in human but in plant and lower animal life, is this Hobbesian war of each against all.

Today, however, among biologists, a new attitude toward the living world is being exhibited. Freed from the individualistic, competitive pre-suppositions of a narrow philosophy, the sciences of embryology, biology, and psychology are attempting to arrive at the facts of the behavior of living organisms. The result is, as Wheeler puts it: "To us it is clear that an equally pervasive and fundamental innate peculiarity of organisms is their tendency to co-operation. All living things are genetically related as members of one great family, one vast living sympleasm, which, though fragmented into individuals in space, is nevertheless absolutely continuous in time; that in the great majority of organic forms each generation arises from the co-operation of two individuals; that most animals and plants live in association herds, colonies, or societies of the same species. Living beings not only struggle and compete with one another for food, mates, and safety, but they work together to ensure to one another these same indispensable conditions for development and survival. The phenomena of mutualism and co-operation are, indeed, so prevalent among plants and animals, and affect their structure and behavior so profoundly, that there has arisen within very recent years a new school of biologists whose work it is to investigate the interrelations of living organisms. It is evident, then, that from the point of view of scientific biology, co-operation is at least as fundamental to life as is struggle, and the preponderance of adequate opinion is that the "survival of the fittest" is the "survival of the fittest to co-operate."

Having thus put before you the two points of view: one the semi-philosophical assumption of the all-pervasiveness of struggle and its consequent corollary of the real impossibility for any true co-operation; the other that of the modern scientific biologist, who recognizes the fact of struggle, but maintains that mutual aid and co-operation are as true in fact and more significant in development, survival and satisfaction, I purpose summarizing some of the evidence adduced for the latter attitude.

The first clue to the nature and behavior of living matter comes to us in the study of the single cell and its evolution into the more and more complex living organisms. Single-celled animals have three functions, nutrition, reproduction and defence; and these functions, in diversified form, persist throughout all cell life, even in the most complex and highly civilized man. The protozoa takes nourishment, breathes, and moves when stimulated, though only a single cell of protoplasm. All higher organisms are compounded of such cells which have undergone various modifications as a result of living together in a colony, where, after fertilization, the cell dividing into other cells, there comes about a differentiation of function. Certain of the cells become hardened and thickened to serve as protections of the more vulnerable cells. In the higher animals, such protective cells make up what we call the skin, nails, etc. Other cells become specialized for digestive processes. Others, again, function for motion, as in the muscle cells. To co-ordinate all these functions, other cells, called nerve cells, bring the various activities into harmony, and also keep the organisms in adequate relations to its environment. The whole picture which embryology presents to us of the evolutionary development of living matter is thus one of very decided co-operation. It is true that the cells of an organism are not individual in the sense that separate organisms are individual, but if we are to find the adequate functioning of life in its higher forms from indications of its functioning in its development, it is surely of immense significance that nature uses the co-operative method in her bringing the living plant and animal to its full functioning.

In the relations of the lower animals to one another there is accumulating evidence of social life. Wheeler's studies of the behavior of insects is outstanding in its emphasis upon the social life of this type of organism. He does not claim for them any high degree of intellect, but points out the extent to which social organization can be developed and integrated on a purely physiological and instinctive basis. Many of the fossil remains which he has studied, reach back for three hundred million years, so that social co-operation is hardly a new thing—and can scarcely claim to have been originated by the farmers of Western Canada.

The fundamental drives are, of course, food, sex and avoidance. In social conditions these become modified through social stimulation, just as the bee and ant, when they get a chance at food, gorge themselves to the utmost. When an ant is feeding on syrup, her abdomen may be snipped off with a pair of scissors without interrupting her repast. But she appropriates for herself only a very small portion of the swallowed food, and distributes most of it among her nest mates. The social insect, therefore, develops elaborate methods of apportioning the food she gathers, among the adults and brood of the colony, according to their various needs. Then, too, devices are used for economizing in food and for storing it. Not only so, but in many of the insect groups there eventually develops a caste whose specific duty it is to provision the colony—the "workers."

The sex problem is socially even more difficult than that of nutrition. If there is no restraint in reproduction the population will outrun the food supply. The higher social insects rigidly restrict population to a few individuals. Certain females and males are highly fecund—the queens, and drones—while the remaining females are reduced to physiological sterility. These sterile females, however, retain their native parental instincts and look after the brood.

The defense problem also is a serious one. Those insects and their brood are sedentary, or fixed in a particular environment, and as are exposed to unforeseen attacks of enemies, to inundations, or great

changes of temperature. Consequently, they make elaborate nests and fortifications, have developed powerful jaws, hard skulls, and deadly stings. In some of the insect groups, such as the ants and the termites (white ants), a special warrior caste has developed.

It would be impossible here, of course, to summarize in any detail Wheeler's description of the social life of beetles, bees, ants, and termites. Let me just illustrate one phase of the co-operative life on which he lays stress, the food problem. He uses the general term "trophallaxis" to indicate the mutual exchange of food between the adults and the young. The adults give food to the young by regurgitating it from the alimentary canal. But the bodies of the larvae, in return, give off exudations that are delicious to the taste of the adults. By regurgitation there is also the exchange of food between the adults. In some species there is a like exchange between the insects and the guests whom the insects protect. The ants feed and protect mites and aphids in order to secure from them the particles of nectar they secrete.

So far as insect life is concerned, the economic phases of life seem to be pretty well settled on a co-operative basis.

For other phases of co-operation in animal life, I shall have to use as my authority the more or less general observations of Kropotkin. As I said at first, there is a vast field open for scientific investigation, but it has not been explored. Kropotkin calls attention to the communal migrations of land-crabs to the seashore to deposit their spawn; to the sentinels posted by the crabs during the moulting season to prevent the moulted individuals being injured. White-tailed eagles combine for hunting, and, when they have assembled for eating a corpse, some of them keep watch while the others are eating. Pelicans, too, co-operate in their fishing. They fish in numerous bands and having chosen their water, they form a wide half-circle towards the shore and narrow it by paddling shoreward, catching all fish that happen to be within the circle, or, in narrow bodies of water, they may form two such half-circles and approach each other. In general there is evidence of co-operation on the part of every species of bird life, and often between species of different kinds of birds. Bird migrations alone indicate the vast place the co-operative principle has among feathered life.

Among the mammals, the deer, antelopes, wild goats, sheep are far more numerous than the unsocial cat tribes, the lion, tiger, leopard. Rats, muskrats, gophers, etc., are all social, not only working together, but delighting in playing together. It is to their social propensities that the wild horses have been able to survive. Individually, they are ill equipped to meet the attacks of wolf or bear, but when a beast of prey approaches them, several studs unite at once and not even a lion can take one of them. When there comes drought and scarcity of grass, several thousands unite and migrate.

On the whole, those animals which approach man in structure and intelligence are social. They live in bands; are unhappy when solitary; answer the distress calls of any one of their number; cuddle one another in the cold; nurse their wounded; are faithful in their family life.

It is evident, therefore, that social co-operative life is not an exception, but rather a rule or law of nature in animal life; and that it takes on its highest forms as we come to the higher vertebrates. In all stages of evolution, association is found, physiologically and instinctively at first, but as we climb the scale it becomes more and more conscious and purposive. As it advances it gives more and more place to the individual, while yet enabling him to be more consciously social. This co-operation serves all the purposes of the struggle of life. It enables the feeble ants and beetles and termites and birds to find means of protection; it discovers ways by which the food problem is solved; it provides for the reproduction of the species and the nourishment and

protection of the young. Species which practice co-operation live; those which abandon it die out. While there is sometimes struggle for food and for sex within the species, animals will migrate for new feeding places as a usual thing and will break off into new groups rather than struggle in the mating race. I am, of course, speaking of undomesticated animals. If man carries over from the animal kingdom, then there are at least tendencies in him which make co-operation possible; and the success of mutual aid among the lower animals ought to point the way to a successful form of life among mankind.

What are the facts of life among pre-civilized man? It is a mistake to suppose, as Hobbes and Huxley did, that primitive man lived in a state of isolation from, and independence of, his fellows. On the contrary, while there is much that is uncertain concerning primitive man, one fundamental fact stands out clearly and unmistakably, namely, that group life is its dominant feature. All recent ethnological investigations have shown beyond question that the life of primitive man is a social life, that the individual in primitive society derives both his rights and his obligations from membership within a group. The outstanding characteristics of primitive social organization are four-fold:

1. The unit of primitive social life is the kinship group. This is a group of persons who think of themselves as having descended from a common ancestor. In some cases this ancestor is believed to be an animal, in others a hero, in still others, a god. In all cases, there is the thought that the group members are all of a common stock, and a common life circulates in them all.

2. A second feature is the solidarity of the group. Bound together by ties of blood, as they supposed themselves to be, the individuals composing the group thought of themselves only in terms of the group to which they belonged; when one suffered, all suffered; when one was injured, all felt the wrong and were anxious to avenge it. As W. H. Smith puts it: "The members of one kindred looked on themselves as one living whole, a single animated mass of blood, flesh, and bones, of which no member could be touched without all the members suffering. If one of the group has been murdered, they say: 'Our blood has been shed.'" Dudley Kidd, in speaking of the clanship among the Kafir, says: "The sense of solidarity of the family in Europe is thin and feeble, compared with the full-blooded sense of corporate union of the Kafir clan." This seems to be characteristic of all primitive peoples. The group is the unit and each individual within the group regards himself as bound by inescapable ties to all other members of his group. The individual exists only in the group; if for any reason he is expelled, he is an "outcast," an "outlaw." The natural condition of primitive man is not one of isolation or of competition; it is to be within and a co-operative part of the group. The group is not an intellectual conception imposed by authority, it is a felt-out plan arising spontaneously along paths of least resistance.

3. Consequently, whatever rights belonged to the individual belonged to him by virtue of his membership within the group. Generally speaking, the primitive group was communistic in the possession of property, and the individual owned property only as a member of the group. No rights existed outside the group, not even justice.

4. The fourth characteristic is that of collective responsibility. The group as a whole is held responsible for the acts of its members when such acts concern any members of another group, and the group as a whole holds itself responsible for the avenging of any injury to one of its own members. Competition is between group and group, rather than between individual and individual. Man is by nature, as Aristotle said long ago, a social animal, and co-operative group life is the flowering of his nature. As evidence of this co-operative characteristic in primitive man, I select the following from Kropotkin. He de-

scribes the natives of Australia, describes life among the Eskimos, and describes higher life among the Indians:

"The natives of Australia do not stand on a higher level of development than their South African brothers. Their huts are of the same character; very often simple screens are the only protection against cold winds. In their food they are most indifferent: they devour horribly putrefied corpses, and cannibalism is resorted to in times of scarcity. When first discovered by Europeans, they had no implements but in stone or bone, and these were of the roughest description. Some tribes had even no canoes, and did not know barter-trade. And yet, when their manners and customs were carefully studied, they proved to be living under that elaborate clan organization which I have mentioned on a preceding page.

"With the Eskimos and their nearest congeners, the Thlinkets, the Koloshes, and the Aleoutes, we find one of the nearest illustrations of what man may have been during the glacial age. Their implements hardly differ from those of palaeolithic man, and some of their tribes do not yet know fishing—they simply spear the fish with a kind of harpoon. They know the use of iron, but they receive it from the Europeans, or find it on wrecked ships. Their social organization is of a very primitive kind, though they already have emerged from the stage of 'communal marriage,' even under the gentle restrictions. They live in families, but the family bonds are often broken; husbands and wives are often exchanged. The families, however, remain united in clans, and how could it be otherwise? How could they sustain the hard struggle for life unless by closely combining their forces? So they do, and the tribal bonds are closest where the struggle for life is hardest, namely, in north-east Greenland.

"The village communities of the natives of both Americas have the same character. The Tupi of Brazil were found living in 'long houses' occupied by whole clans, which used to cultivate their corn and manioc fields in common. The Arani, much more advanced in civilization, used to cultivate their fields in common; so also the Cuzages, who had learned under their system of primitive communism and 'long houses' to build good roads and to carry on a variety of domestic industries, not inferior to those of the early mediæval times in Europe. All of them were also living under the same customary law of which we have given specimens on the preceding pages. At another extremity of the world we find the Malayan feudalism; but this feudalism has been powerless to unroot the negaria, or village community, with its common ownership of at least part of the land and its redistribution of land among the several negarias of the tribe. With the Aikurus of Minahasan we find the communal rotation of the crops; with the Indian stem of the Wyandots we have the periodical redistribution of land within the tribe, and the clan-culture of the soil; and in all those parts of Siamra where Moslem institutions have not yet totally destroyed the old organization, we find the joint family (*sukra*) and the village community (*kota*) which maintains its right upon the land, even if part of it has been cleared without its authorization."

Thus the co-operative principle which we find to hold in the building up of the individual organism, and which plays an immense part in the evolution of the animal world, is just as "natural" and as significant among primitive men. As Kropotkin puts it: "Man is no exception to nature. He also is subject to the great principle of mutual aid which grants the best chances of survival to those who best support each other in the struggle for life. . . . Sociability and need of mutual aid and support are such inherent parts of human nature that at no time of history can we discover men living in isolation, fighting each other for the means of subsistence."